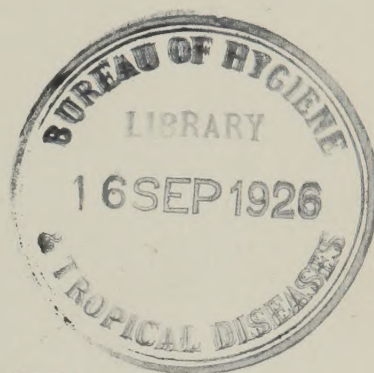


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REPORT
ON
MALARIA-CONTROL
IN
CEYLON PLANTATIONS

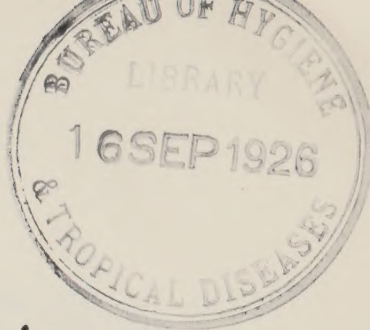
BY
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MALARIA - CONTROL *in* CEYLON PLANTATIONS

A REPORT delivered to the Ceylon Association, London,
on the 9th April, 1926.

BY

Sir RONALD ROSS, K.C.B., K.C.M.G., F.R.S.,

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On the 26th October last year I addressed the Ceylon Association regarding Malaria-Control in Tropical Plantations. I was obliged to speak on the general subject because I then possessed little experience of the local conditions in Ceylon—with which we are specially concerned; but I emphasised the importance of malaria-control in warm climates and urged that the only way to achieve it in tropical plantations is for the affected plantations to organise a system under which they can always obtain expert advice regarding their own particular problems of defence. Following upon this lecture it was suggested that I myself should go to Ceylon in order to study the subject at first hand. The Ross Institute, which has been founded for such purposes and has received much welcome support from Ceylon, assented; and the expenses were generously guaranteed by the Colombo Commercial Company; by Messrs. Rowe, White & Co.; by the Ceylon Tea Plantations Co.; by Messrs. Harrisons & Crossfield; and by the Grand Central (Ceylon) Rubber Estates. Consequently, I left Liverpool by the Bibby Line on the 11th December, 1925, and arrived at Colombo on the 4th January, 1926. I remained in Ceylon for more than six weeks, left Colombo on the 17th February, and returned to London via Marseilles on the 7th March.

On arrival in Ceylon, I received a very kind welcome from His Excellency, the Governor, Sir Hugh Clifford; from the Hon. Dr. J. F. E. Bridger, Principal Civil Medical Officer; from Mr. H. F. Carter, the Government Malariologist (who had been with me at the Liverpool School of Tropical Medicine years previously); and from many other gentlemen. Next day, Mr. W. Forsythe (a member of the Council of the Ross Institute) and Mr. C. D. Sparkes took me for a preliminary survey of estates in the Kelani Valley; and on the same day I gave an address to the Ceylon Estates Proprietary Association at Colombo, Mr. G. C. Slater in the chair. On the 8th January, I addressed the Planters' Association of Ceylon at Kandy, Mr. J. W. Oldfield in the chair. Meanwhile, my tour among the estates was arranged by Mr. Slater, Mr. Forsythe, and Mr. C. L. Carson-Parker; and during the tour I was invited to address the planters at Tebuwana Club on the 16th January; at Kaluganga Gymkhana on the 20th January; and at Ratnapura on the 30th January. My warm thanks are due to the kind hosts who entertained me during the tour—to Mr. H. W. Roy Bertrand at Govinna Estate; to Mr. and Mrs. E. C. Hawkins at Dumbara Estate; to Mr. E. Gordon Brooke at Hanwella Estate; to Mr. and Mrs. A. J. Ingram at Pelmadulla Estate; to Mr. and Mrs. C. de E. Collin at Pitiakande Estates; to Mr. J. Sheridan-Patterson at Delwita Estates; and to Mr. H. D. Garrick (to whose enthusiasm for the Ross Institute it is so much indebted) at Ukuwela. I am also much obliged for hospitality and also for information to Mr. and Mrs. Slater; to Mr. and Mrs. Oldfield; to the Hon. Mr. and Mrs. Kindersley at Kandy; the Hon. Mr. T. L. Villiers, Mr. John Still, Mr. Blythe, Mr. and Mrs. Wedderburn, and Mr. Sudbury at Anuradhapura, and to other obliging friends. At Anuradhapura, Mr. Carter, the Government Malariologist, and Mr. W. H. Schokman who assists him there, showed me their careful and successful mosquito-control works now in course of elaboration. Before departure, I broadcasted on the subject of Malaria at the Central Telegraph Office, and again addressed the Ceylon Estates Proprietary Association on the 15th February; and lastly, received the hospitality of their Excellencies, Sir Hugh and Lady Clifford at Colombo. My only regret is that want of time compelled me to decline some invitations to lecture and obliged me to forego calling upon some gentlemen whom I particularly wished to see. I am also much indebted to Sir James Lochore and to Mr. W. Shakspeare (Vice-Chairman of the Ross Institute) for valuable assistance; and last, but far from least, to Mr. G. H. Masefield, for his fully-informed and whole-hearted support of malaria-control in Ceylon, as well as for organising my visit there.

It will be unnecessary for me to repeat the general remarks on malaria which I made before the Ceylon Association last October; but it is advisable to re-emphasise some points there dealt with. One cannot say that beyond a few special anti-malaria campaigns here and there, the British Empire has fully utilised even yet the discovery that malaria is carried by *Anopheles* mosquitoes—which was made in 1898-99, more than a quarter of a century ago. The explanation of this delay is that, theoretically, malaria may be prevented in several different ways (namely, by the use of mosquito nets, by the application of “culicifuges” to the skin, by the regular taking of quinine, by segregation, and by the general method of mosquito control) so that sanitary officers have been divided by their own embarrassment of riches in regard to malaria-prevention; some have preferred one method and others have preferred another method, while the governments of our tropical dependencies have never been able to allot large enough funds for any of such work on general scales. The great successes against malaria, namely, those in the Federated Malay States, in the Panama Canal Zone, and in the Suez Canal Zone, have been effected by wealthy companies rather than by colonial administrations; and governments can scarcely be expected to allot large sums until a full decision has been reached regarding the best manner in which to employ those funds.

During the whole of this “negative phase” however, there has been a steady advance in one direction, due partly to enthusiastic medical men and partly to well-trained entomologists—I mean the determination of the exact species of mosquitoes which carry malaria in different countries and the detailed observation of their habits, their breeding places, their seasonal prevalence, and their capacity as carriers of the disease. These studies have been set forth in a number of admirable scientific publications—which, of course, are little known to the general public. It cannot be any longer pretended, as was pretended twenty years ago, that we do not possess sufficient knowledge of mosquitoes to justify us in spending money for controlling them. But, as I have said, though we have now obtained all or most of the knowledge necessary for mosquito control, yet the final stage of active public mosquito-repression has scarcely been reached even now.

But there is one direction in which I have observed a very distinct improvement. Apart from the *Anopheles* mosquitoes which carry malaria, there are in the tropics, as everyone knows, a number of domestic species belonging chiefly to the genera *Culex* and *Stegomyia*, which commonly infect all human dwellings and which cause much annoyance to human beings, while they even sometimes carry dengue, yellow fever, and filariasis. The whole time that I was in India, from 1881 to 1899, I always observed that these species tended to swarm in private houses, hotels, and even in hospitals; and I frequently estimated that, in spite of mosquito-nets, punkas, fans, and thick socks, I was bitten at least two or three times every twenty-four hours by one species or another. In some places the plague of mosquitoes became more than a mere annoyance—for instance, I remember my own miserable experiences when I stayed for a night in a Colombo hotel in the year 1888. The insects abounded everywhere in the tropics. They would bite one's ankles at dinner parties and would show extreme intelligence in entering mosquito nets with the smallest holes in them. Even so late as 1902, when Sir William MacGregor and I stayed in the Suez Canal Company's houses at Port Said and Ismailia (whence the mosquitoes have now been banished) we were plagued almost beyond endurance by them. I have not visited India again since 1899 (except for a week's stay at Bombay in 1908), until the visit to Ceylon now being dealt with; and I notice an immense change in this respect. During the whole six weeks of my stay I do not remember to have been bitten once (though I am a very popular subject of mosquitoes' attentions) and I saw only about six mosquitoes the whole time, during which I resided in four large hotels and in seven planters' houses, and visited several other buildings. Doubtless the domestic mosquitoes still continue to abound in many private houses, in native huts and habitations, and elsewhere; but the improvement already manifest in the hotels and other places mentioned is a welcome augury for the future. The mere comfort of life in the tropics is vastly enhanced by the absence of these little pests, the common domestic mosquitoes. The improvement has been due simply to the spread of knowledge. Nearly everyone in the tropics now knows that mosquitoes may carry diseases and that they breed largely in gutters, in pots and tins round houses, in water butts, and in roof-gutters. Intelligent persons can reduce the plague in their own houses in many places, though certainly not in all. The improvement has been a sub-conscious one, which can scarcely be detected except by those who, like myself, have had a long previous experience of tropical life.

Malaria, however, is not carried by these domestic species of mosquitoes, but by the *Anopheles*, most of which breed in natural ground-waters apart from habitations or not necessarily close to them. No single householder can decree the banishment of *Anopheles* from his house simply by looking after his own premises. For *Anopheles* concerted public action is necessary. And now I have great pleasure in recording the admirable work done recently in Ceylon by the Public Health Department of the colony, especially by Dr. Bridger and the malariologist, Mr. Carter. Mr. Carter was appointed only a few years ago but has already done an immense amount of detailed, but necessary, researches on the mosquitoes in the island, especially the *Anopheles*. His office in Colombo is a useful, though not a large one; and it has been collecting extensive records of the habits and distribution of the insects—with the assistance of several capable workers. Carter's brochure on the *Anopheline Mosquitoes of Ceylon* (The Times of Ceylon Co., Colombo, April, 1925) is a brilliant little compendium, and his reports already published in the *Annual Report of the Medical Department, Ceylon*, for 1924, pages 3 and 53, give much exact knowledge necessary for malaria-control throughout the island. During my visit he was engaged upon writing a still fuller report; and I was glad to hear that his services are to be continued in the colony. We may be convinced that under Dr. Bridger the work of malaria-control will be pushed as far as funds and circumstances allow. In fact, the malariological department is another advance far beyond anything which I saw in the east before I left it in 1899. With enlargement, with more generous financial support, and with the more enlightened assistance of the whole public in Ceylon, it will, I am convinced, effect a very great improvement as regards malaria throughout the colony.

Another piece of work done by Mr. Carter has been to make an estimate of what are technically known as spleen-rates in Ceylon. This test consists in ascertaining the proportion of people in any locality who show enlargement of the spleen—a pathological condition due, with rare exceptions, in Ceylon only to malaria. I need not discuss the method here. It has been employed throughout the tropics for many years. Roughly speaking, the larger the spleen-rate, that is, the greater the proportion of people with enlarged spleen in a locality, the greater the rate of malarial infection in that locality. Further refinements are obtained by noting the average sizes of enlarged spleens in the inhabitants; and the test is specially valuable amongst the

new comers, that is the children. Mr. Carter has prepared many maps showing the spleen-rates in very many areas all over Ceylon, and I was able to verify some of these rates in the neighbourhoods visited by me. From these it appears that malaria is most prevalent, as he says, in the plains to the north and east of the central mountain mass; and this fact is largely, if not quite fully, explained by the special prevalence of the malaria-bearing species of *Anopheles* in the affected districts.

All these are technical matters which it is unnecessary for me to discuss here, as they have been already fully dealt with in the reports of Dr. Bridger and Mr. Carter. I myself was concerned specially with malaria in the plantations, and the best organisation for dealing with it. Here we may remark, to begin with, that the official Malaria Department, appointed and paid for by Government, is necessarily concerned chiefly with the towns and villages of the general population. As with sanitary departments elsewhere, it cannot with its present income and organisation deal fully with private estates, that is, with large rural areas distinct from the civil population. Government keeps an eye on housing schemes, general sanitation, hook-worm disease, and other communicable maladies; but the public funds now available will scarcely suffice for anti-malaria sanitation for the whole of the 25,365 square miles in the island. The main point for me to consider then in reporting upon malaria control on private estates in Ceylon was concerned with the best organisation for this special purpose.

Two courses appear to be open to the planters, namely:—

Scheme A.—To contribute funds to the Colonial Malaria Department in order to enable it to inspect and advise upon malaria-control for every malarious plantation, as well as for the general population.

Scheme B.—To appoint one or more Plantation-Malaria-ologists for the special purpose of dealing with plantation-malaria—to work, of course, in touch with the Government Malaria Department as much as possible, but to be supported by the Estates.

I had several conversations with Dr. Bridger and Mr. Carter on these points, and also consulted the Office of the Colonial Secretary about them. Regarding Scheme A, there appears to be some difficulty as to whether Government would accept *ad hoc*

contributions from any private properties. This point could not be decided during my brief visit; but, personally, I should think that arrangements ought to be quite feasible, given goodwill on both sides. The Colonial Malaria Department would have to survey all the malarious estates in order to detect the breeding areas of the mosquitoes, and would then have to advise and help managers of the estates as to how best to deal with these breeding areas. This would imply merely an enlargement of the staff of the Malaria Department enabling it to cover the estates as well as the towns and villages of the general population. What I had in mind under this heading was that the planters might contribute an annual sum to the Colonial revenue, but ear-marked for the express purpose of malaria-control in the plantations, in order to provide as many assistants to the Colonial Malaria Department as it would require to enable it to deal with the malarious estates. But this would involve certain administrative difficulties between the planters on the one side and Government on the other, and I was not sure when I left Ceylon that these administrative difficulties could be overcome.

If they cannot be overcome, then the planters should take steps to appoint special malariologists for looking after their own estates (Scheme B)—as has been done so successfully by the planters in the Federated Malay States, assisted by Sir Malcolm Watson, Mr. C. Strickland, and other gentlemen there. Under this heading I should strongly advise the planters to acquire the services of at least one active, fully-trained and qualified European to advise all the malarious estates, with necessary assistance. Unfortunately, the number of such men available is by no means large at the moment. I fear I can suggest only a few names, while men who are sufficiently qualified for the work and also possess a knowledge of local conditions in Ceylon are very few indeed. Whoever is appointed must be given a proper salary, with sufficient tenure, and some arrangements for a pension, because a short-time man will scarcely be able to throw his whole heart into the subject. He must be provided with a house at a central spot, a motor car, and also a small laboratory; and will certainly need some native assistants, and perhaps even a European one later on, at least during the malaria season. His work will be fairly heavy until he has made accurate malaria surveys of the affected properties, and his time should not be spent on hospital or other medical practice; but perhaps other sanitary duties in connection with the estates may be entrusted to him subsequently—so that he might ultimately develop into an Estates' Health Officer.

Several of us who considered the matter together thought that the cost would be about £2,000 a year, at least. This would be exclusive of the cost of the actual mosquito-control measures, which would have to be borne, when possible, by each affected estate for itself. Whether Government would render financial help for Scheme B I cannot say, but it may be asked for.

On the other hand, Scheme A might cost the planters less because their malariologist would be already provided by the Government Health Department and the estates would have to pay only for such assistants as he might require for inspection and supervision in them. In both cases they will probably have to pay at least part of the cost of the actual mosquito-control measures, whatever these may be.

I laid these alternatives before the Ceylon Estates Proprietary Association before my departure; but discussion regarding them was not then sufficiently advanced to enable me to advise definitely which of them would be the better one. I formed such a high opinion of the Government Malaria Department that I should like to see the whole anti-malaria work in Ceylon placed under it, if possible, for the sake both of economy and of unity of control (Scheme A). Failing this, the second alternative (Scheme B) should be adopted—and I can see no third course available.

Both alternatives will be, and must be, a source of expense. All malaria-control, and, indeed, sanitation in general, is a source of expense. But it is not yet always clearly apprehended that malaria, like other diseases, is also a source of expense—and usually of much greater expense than preventive measures are likely to be. It is useful to consider this subject from a strictly business point of view, quite apart from humanitarian interests. Every case of malaria, both among staffs and among labourers, costs money; and sometimes large sums of money have to be wasted under this heading. Here, for example, is a table prepared by one of the most capable rubber planters in Ceylon before my arrival (except for the last column). It gives the actual loss in the tapping of the rubber-trees due to shortage of labour caused chiefly by malaria in December and January last in a group of five estates under him. Estate I is some hundreds of feet up on the hill above the plain; Estate II is lower down and nearer the plain; and Estates III, IV and V are right out on the plain away from the slope of the hill.

Malaria-Expenses and Spleen-Rates on a Group of Four Contiguous Estates in Ceylon.

		December, 1925, Tapped 31 Days.				January, 1926, Tapped 27 Days.				
		No. of Tapping Blocks of trees.	Actual Tapped.	Shortage.	Total loss in money.	No. of Tapping Blocks of trees.	Actual Tapped.	Shortage.	Total loss in money.	Spleen- rate.
ESTATE I	...	527	495	32	Rs. cts. 299.20	476	476	nil	Rs. cts. nil	15%
ESTATE II	...	310	266	44	411.40	270	234	36	367.20	51%
ESTATE III	...	1798	1587½	210½	1967.75	1566	1141	425	4335.00	76%
ESTATE IV	...	1209	713	496	4637.60	1053	506	547	5579.40	76%
ESTATE V	...	1230	997½	232½	2173.45	1148	887	261	2662.20	not taken
		5074	4059	1015	9489.40	4513	3244	1269	12943.80	
		Total Crop in December 22896 lbs. @ 5½ lbs. per coolie, 5582 lbs. loss @ Rs. 1.70 = Rs. 9489.40				Total Crop in January 19874 lbs. @ 6 lbs. per coolie, 7614 lbs. loss @ Rs. 1.70 = Rs. 12943.80.				

It will be observed that the cost of the malaria increases in the same order. Now I took the spleen-rates on the first four estates before I had seen the Manager's table; and these spleen-rates are here entered in the last column. It will be seen that they vary remarkably in agreement with the monetary loss shown by him. That loss amounted to nearly £1,000 for the five estates in *January* alone, and varied from *nil* on Estate I on the hill (with a spleen-rate of only 15 per cent.) to a sum of Rs.5,579 on Estate IV on the plain (with a spleen rate of 76 per cent.) The increase of the spleen-rates (and of the pecuniary losses) in the estates on the plain were due to the greater frequency of the breeding-waters of the dangerous *Anopheles* there than on the slopes of the hill.

I have no doubt that similar figures can be obtained for all the estates in the island; and, besides the waste of productive labour, numerous other expenses are caused by the disease—hospital and other medical expenses, maintenance of families, and so on. My main argument is, therefore, why waste thousands a year in consequence of malaria when a few hundreds a year may suffice to prevent or at least diminish it? Even if the preventive measures cost as much as the malaria costs (which will probably be very seldom the case), the humanitarian benefit in the saving of sickness and death will still turn the scale in favour of prevention. There is no alternative left—either prevent your malaria or continue to lose thousands a year in consequence of it.

How should the money be raised to pay either for Scheme A or for Scheme B? Evidently by subscription. The planters themselves must agree upon the terms; but the following points may be submitted for their consideration. The Ceylon estates may be classified as follows:—

- Group 1.—Estates (chiefly tea-estates) which are above or outside the malaria range and on which only imported cases occur.
- Group 2.—Estates within the malaria range, but on which epidemics of malaria occur only occasionally.
- Group 3.—Estates whose coolies become infected from adjacent areas such as neighbouring estates, or towns or villages.
- Group 4.—Estates whose malaria is due to their own mosquito-breeding areas.

Until complete malaria-surveys of all the estates have been made, it will be difficult to say to which group any one estate belongs, except perhaps those happy plantations of Group 1, which are entirely above the malaria range. On many estates malaria may be absent to-day but may abound to-morrow (Group 2), and then in consequence either of contiguous *foci* of infection (Group 3) or of their own breeding waters (Group 4). Malaria is a disease which is by no means always fixed to the same localities, but of which wide epidemics may occur (as shown by numerous careful investigations). In such epidemics the estates of Group 1 may be put to considerable expense in consequence of imported cases, and even such estates are therefore distinctly interested in the whole subject. I conclude, therefore, that it would be proper for *all* the estates to join in the malaria subscription; and as many estates (Group 3) suffer from infections contracted in neighbouring houses, villages, and towns, I think that Government may justly be asked to assist either Scheme A, or by adding an adequate sum to Scheme B. If all the estates in Ceylon can be persuaded to subscribe, the total cost to each would be inconsiderable as regards the malariological department itself; but actually malarious estates (Group 4) would still have to bear the cost of dealing with their own breeding waters, unless neighbouring estates or Government can be induced to help—as may often be the case. Pending consultations and decisions on these points, I advise the more progressive estates to raise a “ malaria subscription ” at once among themselves and to set to work without delay. They are likely to save much of the money they are now spending in consequence of the disease; and other estates are sure to join them as soon as good results become manifest. All the main scientific facts have been demonstrated for many years; and there is no good reason for procrastination.

The Ceylon Public Health Department has already commenced considerable schemes for malaria-reduction at Trincomalee, at Anuradhapura, at Mahara Prison, and elsewhere, chiefly by mosquito-control. Apart from older attempts in this line, a campaign has recently been described in the Supplement to the Indian Medical Gazette, March, 1926, page 1, which says, “ Mr. R. Senior-White, F.E.S., records the eradication of malaria from a rubber estate in Ceylon with a total population of 357 souls. From 1914 to 1921 malaria cost the estate approximately Rs.831 per annum in loss of working days, and the population of 357 shewed an annual average of 830 admissions to hospital for malaria. The expenditure upon prophylactic quinine was Rs.352 per annum. In 1919 a survey was carried out, and

A. maculatus (an Anopheline mosquito) incriminated. Its breeding places were thoroughly dealt with, chiefly by oiling, at a cost of Rs.195 per annum. The annual average number of deaths from malaria dropped from 13 to 4, with an estimated saving of Rs.480 per annum on increased number of days' work. The example is a small one, but it is typical of results which can be multiplied almost indefinitely upon a much larger scale." See also a paper by Mr. Senior-White in the Bulletin of Entomological Research, January, 1926 (Imperial Bureau of Entomology, 41, Queen's Gate, London, S.W.7), which has just reached me.

In 1902-3, the Suez Canal Company, acting on my advice, entirely cleared its capital town Ismailia, of mosquitoes, *Stegomyia*, *Culex*, and *Anopheles* (and also of its malaria), and a few years later, Dr. E. H. Ross achieved the same result at Port Said. When we passed through the Canal during my recent journeys both to and from Colombo, I heard from several residents in those towns that this happy riddance has been maintained by the local sanitary authorities. It is notorious also that several large cities in North and South America (besides the Panama Canal Zone) have also been almost entirely freed from the mosquito-plague. The day will come when all well-managed towns and estates in the tropics will get rid of mosquitoes just as they now deal with bugs, lice, and other vermin—not to mention lions and tigers!—and the whole of my advice to Ceylon is to follow these excellent examples as soon as possible.

The other methods for malaria-reduction besides mosquito-control have been tried in Ceylon, but are not very favourably reported upon by Mr. Carter. Coolies and their families can seldom be persuaded to take quinine regularly, except when they have fever; and when I was Consultant in Malaria at the War Office during the war quinine-prophylaxis in Salonika and elsewhere proved to be only a temporary safe-guard against malarial fever. Nets and screens, culicifuges, gloves and veils are also impossible for coolies, and are useful only in the absence of proper mosquito-control; and, as I have said, I was not conscious of being bitten in Ceylon, in spite of faulty bed-nets, or often no bed-nets at all. Mr. Carter is breeding large numbers of the small fish which eat mosquito larvæ, and he finds them useful in wells. In my opinion, inadequate or unnecessary wells should be filled up altogether as much as possible. There are always great difficulties connected with *paddy-fields*, which often, though by no means everywhere, breed the dangerous species of mosquitoes: the rice-plots cannot usually be drained away without

interfering with private rights and are in different conditions at different seasons, sometimes suitable and sometimes unsuitable for *Anopheles* larvæ. In fact, this point, and the question of borrow-pits, seem to provide the principal problems of *Anopheles*-control in Ceylon. The future is sure to yield improved solutions.

This is not the place for technical details, but mention should be made of "Paris Green," a fine chemical powder, which, when blown on to the surface of a pool poisons the *Anopheles* larvæ only, as demonstrated in America. A sample given to me by the Colombo Commercial Company was handed over to Mr. Carter for trial; and the number of the Indian Medical Gazette already mentioned describes a very encouraging experiment in Bombay with this substance (page 115). The drawback about it is that it does not kill other mosquito larvæ. For a quarter of a century I have urged that search should be made for an *ideal larvicide*, which can be thrown on to pools in the form of small pellets that will float on the surface of the water and destroy all kinds of mosquito larvæ there without injuring crops or cattle—and I hope to recommence the investigation this summer (after previous failures). Recent studies of the relations between larvæ and the hydrogen-ion contents of various waters made by MacGregor, Buxton, and Senior-White (op. cit.) are also very promising—though one suspects that these conditions may affect the food of the larvæ more than the larvæ themselves directly.

Somewhat too much is being made of small differences in the habits of different species of *Anopheles*' larvæ. In his selection of waters which require treatment for malaria-control, the wise malariologist will look not only at those which breed culpable mosquitoes to-day, but also at those which may do so to-morrow. He will, moreover, try to remember waters which breed mosquitoes that annoy without carrying any infection. He will cast the net of mosquito-control as widely as possible so as to include as many of the insects as he can. The costs may sometimes be a little more, but the results are likely to be far more complete and satisfactory. On the other hand where the costs are likely to be much more, he will have to think twice over his recommendations: and the conclusion must depend on local conditions.

I was told that the malaria-bearing species of *Anopheles* have not even yet been fully and satisfactorily incriminated in Ceylon by cultivating or finding the malaria-parasites in them. This should be done at an early date. Quite possibly, if not

probably, certain local varieties even of known malaria-bearing species of *Anopheles* may be innocent, and *vice versa*. Strain as well as species is sometimes concerned in the carriage of parasites.

Much annoyance is caused in many estates in Ceylon, as well as in numerous other parts of the world, by minute little black flies commonly called Eye Flies, which constantly buzz in the eyes and ears, specially in open verandahs during the heat of the day. Very little definite appears to be known about these insects; but from the fact that they abound much more in certain spots than in other places I conjecture that they breed in connection with some kind of plant or tree, or in some other purely local sites. If so, they might be easily diminished or even banished. I suggest, therefore, that the planters might have these flies thoroughly investigated, if possible. They are also supposed to carry inflammation of the eyes, and, in fact, one of my children acquired a most severe attack of conjunctivitis in Bangalore many years ago, probably owing to infection carried by these little creatures.

In conclusion, I hope that malaria-control will shortly become general in Ceylon, as it is now likely to do in parts of the Indian Empire. All the conditions for advance are present there, and only a suitable organisation for private estates remains to be established. This, I am sure, will shortly be done.



~~all over~~
Ceylon

T. malacca:
Pavilion
G.H.